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(54) I.c engine fuel injection valve fuel supply device with integrated leakage oil discharge

(57) A pipe socket 13 is received in a passage 11 in the cylinder head 1, has a high pressure connection 33 to its inlet line 19 and is clamped axially against a conical seat 9 in the valve retaining body 5. In order to discharge leakage oil form the leakage oil chamber 25, the pipe socket 13 is provided with a leakage oil bore 47 which extends from an annular shoulder 23 and opens into a leakage oil socket 49 at the angled part of the pipe socket 13. With the integration of the leakage oil discharge into the pipe socket there is no need for additional bores and connections in the cylinder head.

Fig. 1

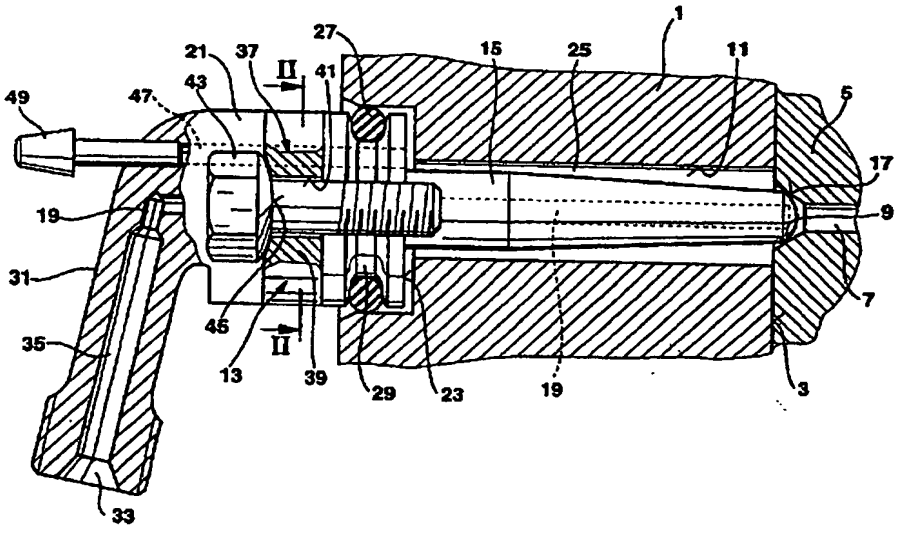

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Fig. 1

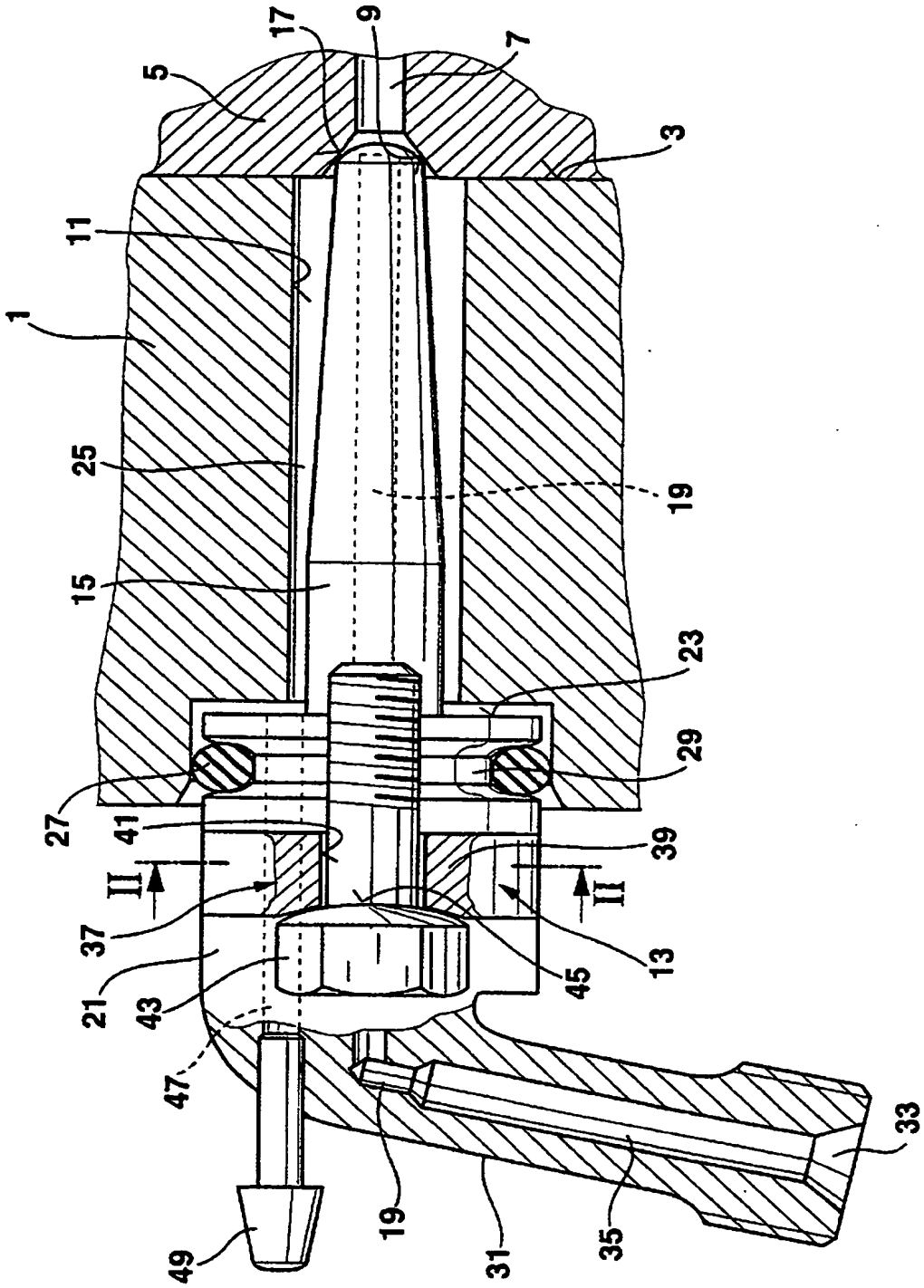
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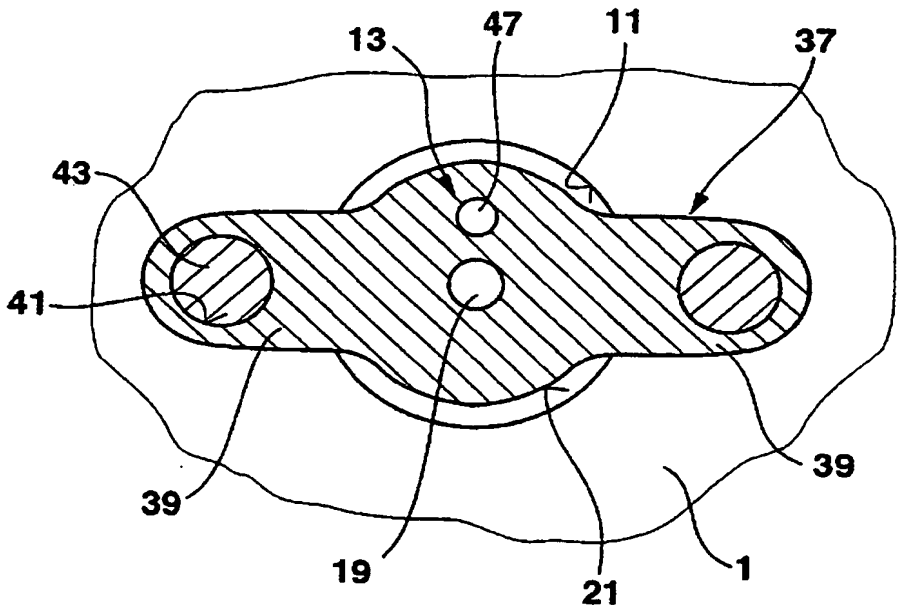
Fig. 2



Fuel supply device

State of the art

The invention proceeds from a fuel supply device, in particular for a fuel injection valve fitted in a cylinder head of an internal combustion engine according to the generic type of claim 1. A fuel supply device of this type known from EP 0 569 727 B1 comprises a pipe socket, which projects into a passage in a cylinder head. In this case, the pipe socket, at its inflow end for a high pressure bore or high pressure line, comprises a high pressure connection, to which a high pressure line leading from a high pressure source, e.g. an injection pump, can be connected. At its outflow end, the pipe socket comprises a sealing surface, by means of which the pipe socket is axially clamped against a conical seat on the retaining body of the fuel injection valve.

The known pipe socket is clamped against the fuel injection valve by means of a retaining nut, which encloses the pipe socket and is screwed into the through bore of the cylinder head. At the inflow end of the pipe socket projecting axially from the through bore of the cylinder head, the high pressure line is connected to the high pressure connection by means of a further retaining nut. The leakage oil discharge from a leakage oil chamber formed between the shaft of the pipe socket and the through bore of the cylinder head enclosing said shaft is effected in a manner which is not further illustrated via an additional bore in the cylinder head.

The known fuel supply device thus has the disadvantage of requiring additional machining of the cylinder head for the leakage oil discharge, which results in increased manufacturing costs. In addition, the axial connection of the high pressure line requires increased and geometrically fixed structural space on the internal combustion engine which is to be supplied. This space is only available

to a limited degree in modern internal combustion engines.

Advantages of the invention

In contrast, the fuel supply device according to the invention having the characterising features of claim 1 offers the advantage that the device for discharging the leakage oil is integrated in the pipe socket, so that there is no need for additional bores and connections to the cylinder head of the internal combustion engine. To this end, a leakage oil bore is provided in the pipe socket in a structurally simple manner, leading from the leakage oil chamber between the pipe socket and the through bore and opening into a leakage oil connection socket on the pipe socket which can be constructed as a leakage oil connection pipe or as a screw connection socket.

In order to make room for the leakage oil connection socket, the inflow end of the pipe socket projecting out of the through bore in the cylinder head is angled in accordance with the invention, which offers the additional advantage of high flexibility in respect of the assembly position and the connection of the high pressure line. The connection socket of the leakage oil bore is fitted in the angled section of the pipe socket as a simple axial extension of the leakage oil bore, so that additional cross bores or the like leading off from the leakage oil bore are unnecessary.

A further advantage is attained by the provision of a securing flange with tongues projecting radially from the pipe socket. Receiving bores are provided in said tongues for receiving securing screws, by means of which the pipe socket is axially clamped against the cylinder head. In this respect, the pipe socket rests with its sealing surface provided at its outflow end in a sealing-tight manner against a seat of the retaining body of the injection valve, the spherical or curved

sealing surface in association with the conical shape of the seat compensating any axial or angular displacement of the components within a given tolerance range.

This possible tolerance compensation is supported by the curved annular end face of the securing screws and the axial spacing between the cylinder head wall and the flange, which thus also allows for a given displacement of the components relative to one another at the site where the fuel is introduced into the pipe socket.

The high pressure line extending in the angled, inflow end of the pipe socket is constructed in such a manner that a fuel filter constructed as a filter cartridge can be easily fitted in said high pressure line element from the high pressure connection.

The pipe socket fulfilling the various described functions is advantageously integrally formed with the securing flange and can be constructed as a forged part or rotationally symmetrical turned part, in which the free, inflow section can be subsequently bent as desired. In cases where the pipe socket is constructed as a turned part, the securing flange extends over the entire circumference of the pipe socket.

The fuel supply device according to the invention is suitable for connection to a fuel injection valve fitted in the cylinder head of an internal combustion engine. However, it can also be used on similar components, such as pumps.

Further advantages and advantageous developments of the subject matter of the invention will be clear from the description, the drawings and the claims.

Drawings

An embodiment of the fuel supply device according to the invention is illustrated in the drawings and explained in further detail in the following description. Figure 1 is a section through the pipe socket fitted in a cylinder head of an internal combustion engine and Figure 2 is a section through Figure 1 taken along line II-II.

Description of the embodiment

In the embodiment of the fuel supply device according to the invention illustrated in Figure 1, a known fuel injection valve is fitted in a cylinder head 1 of an internal combustion engine in a bore 3 opening into the combustion chamber of said internal combustion engine. Only part of the valve retaining body 5 of said valve is illustrated in Figure 1. For the fuel supply, the valve retaining body 5 of the injection valve comprises a radial bore 7, whose outlet opening forms a conical seat 9. In alignment with this seat 9, a passage in the form of a stepped through bore 11 is arranged in the cylinder head 1, into which through bore a pipe socket 13 with a cylindrical shaft extension 15 projects. In this respect, the outflow end of the pipe socket 13 adjoining the seat 9 forms a sealing surface 17, which cooperates with the seat 9 and curves spherically outwards. The sealing surface 17 constructed as an annular surface radially defines a high pressure line 19, which penetrates the entire pipe socket 13, is preferably constructed as a high pressure bore and opens into the bore 7 in the valve retaining body 5.

Adjoining the cylindrical shaft 15 which tapers conically towards the seat 9, the pipe socket 13 comprises a central section 21 which has an enlarged diameter and projects out of the stepped through bore 11 of the cylinder head 1, an annular shoulder 23 being formed at the cross sectional transition to the shaft element 15. In this respect, a leakage oil chamber 25 is formed in the cylinder head 1 between the circumferential wall of the pipe socket 13 and the wall of the through bore 11, said chamber being sealed towards the outside by means of a sealing ring 27

which is clamped between the circumferential wall of the central section 21 of the pipe socket 13 and the wall of the through bore 11. The sealing ring is guided in a circumferential groove 29 in the central section 21 of the pipe socket.

At its free, inflow end, the central section 21 of the pipe socket 13 adjoins a further tubular connecting section 31, whose diameter is reduced as compared with the central section and which is angled relative to the axis of the central section 21 and the shaft 15. The free, inflow end of this connecting section 31 comprises a high pressure connection 33, to which an injection line leading to a fuel injection pump can be connected. The cross section of the high pressure line 19 in the region of the connecting section 31 is enlarged as compared with the remaining region and forms a filter chamber 35, into which a rod-shaped fuel filter can be inserted from the inflow end. The section of the high pressure line 19 forming the filter chamber 35 extends into the section of the high pressure line 19 continuing in the shaft 15.

In order to secure the pipe socket 13 to the cylinder head 1, the pipe socket 13, as also shown in section in Figure 2, comprises a securing flange 37, which is formed by two securing tongues 39 projecting radially from the central section 21. Provided in each of the securing tongues 39 is a receiving bore 41 for a securing screw 43, which are screwed into corresponding threaded bores in the wall of the cylinder head 1 and thus clamp the pipe socket 13 with its sealing surface 17 in an axially sealing-tight manner against the valve retaining body 5. In order to compensate possible angular displacement, the annular end faces 45, which are formed between the shaft and the head of the securing screws 43 and which rest against the flange 37, curve spherically outwards and are guided in corresponding recesses in the securing tongues 39. In addition, a specific gap is provided between the end face of the securing flange 37 facing the cylinder head 1 and the wall of the cylinder head 1, which gap allows for an angular displacement of the

pipe socket 13 within given limits.

In order to discharge the leakage oil from the leakage oil chamber 25, a leakage oil bore 47 is provided in the pipe socket 13, which penetrates the pipe socket 13 axially and extends between the high pressure line 19 and the circumferential groove 29, as also shown in Figure 2. This leakage oil bore 47 extends from the annular shoulder 23 and opens into a leakage oil socket 49, which is fitted in the angled part of the connecting section 31 of the pipe socket 13 and to which a leakage oil outflow line can be connected.

The described pipe socket 13 is integrally formed with the shaft 15, the central section 21, the angled connecting section 31 and the securing flange 37, and is preferably constructed as a forged part.

With the fuel supply device according to the invention it is therefore easily possible from a design point of view to integrate the various functions, such as high pressure sealing and connections, filter accommodation, securing with tolerance compensation and leakage oil sealing and discharge in a single component, so that the need for additional components is dispensed with.

CLAIMS

1. A fuel supply device, in particular for a fuel injection valve fitted in a cylinder head (1) of an internal combustion engine, with a pipe socket (13), which penetrates a passage (11) in the cylinder head (1), comprises a high pressure connection (33) at its inflow end for a high pressure line (19) and at its outflow end is clamped axially with a sealing surface (17) against a conical seat (9) of an inflow in the retaining body (5) of the fuel injection valve, characterised in that means for leakage oil discharge is provided in the pipe socket (13).

2. A fuel supply device according to claim 1, characterised in that means for leakage oil discharge in the pipe socket (13) is formed by a leakage oil bore (47), which leads from a leakage oil chamber (25) formed in the passage (11) in the cylinder head (1), extends from an annular shoulder (23) on the pipe socket (13) closing the passage (11) and opens into a leakage oil socket (49) fitted in the pipe socket (13).

3. A fuel supply device according to claim 2, characterised in that the pipe socket (13) is angled at its inflow end (31) projecting from the cylinder head (1), the leakage oil socket (49) being provided as an axial extension of the leakage oil bore (47) in the knee of the angled section (31) of the pipe socket (13).

4. A fuel supply device according to claim 2, characterised in that the leakage oil chamber (25) formed in the cylinder head (1) between the shaft (15) of the pipe socket (13) and the wall of the passage (11) is sealed by a sealing ring (27) fitted in this region between a section (21) of the pipe socket (13) having an enlarged diameter and the wall of the passage (11).

5. A fuel supply device according to claim 4, characterised in that the sealing ring (27) is guided in a radial circumferential groove (29) in the section (31) of the pipe socket (13) having an enlarged diameter.

6. A fuel supply device according to claim 1, characterised in that a securing flange (37) is provided on the pipe socket (13), the tongues (39) of said flange, of which there are preferably two, projecting radially beyond the pipe socket (13, 21) and each comprising a receiving bore (41) for a securing screw (43).

7. A fuel supply device according to claim 6, characterised in that the end faces of the tongues (39) facing the cylinder head (1) are arranged at a given distance from the wall of the cylinder head (1).

8. A fuel supply device according to claims 1 to 6, characterised in that the securing flange (37) is integrally formed with the pipe socket (13), and the leakage oil bore (47) is arranged between the high pressure line (19) and the radial circumferential groove (29) of the pipe socket (13).

9. A fuel supply device according to claim 7, characterised in that the annular end face (45), formed between the shaft and the head, of the securing screws (43) which are inserted into the receiving bore (41) of the securing flange (37) and are screwed into the wall of the cylinder head (1), is curved spherically outwards.

10. A fuel supply device according to claim 3, characterised in that a fuel filter is fitted in the high pressure line (19) in the angled, inflow section (31) of the pipe socket (13).

11. A fuel supply device according to claim 1, characterised in that the cylindrical pipe socket shaft (15) projecting into the passage (11) in the cylinder head (1) tapers conically towards the outflow end.

12. A fuel supply device according to claim 1, characterised in that the annular sealing surface (17) arranged at the outflow end of the pipe socket (13, 15) curves spherically outwards.

13. A fuel supply device according to claim 1, characterised in that the pipe socket (13) is constructed together with the securing flange (37) as an integral forged part.

14. A fuel supply device according to claim 1 and 3, characterised in that the pipe socket (13) is constructed with the securing flange (37) as a rotationally symmetrical turned part, whose inflow section (31) comprising the high pressure connection (33) is bent following the turning process.

15. A fuel supply device substantially as herein described with reference to the accompanying drawings.

The Patent Office

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Application No:	GB 9702694.2	**Examiner:**	John Twin
Claims searched:	1 to 15	**Date of search:**	21 April 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F1B (B2JCK, B2JCL)

Int Cl (Ed.6): F02M 55/02

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	US 5365907	(Mercedes-Benz)	
X	US 3845748	(Mack Trucks) - see eg col.3, lines 34-36	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.